

REMARKS

Applicants respectfully request reconsideration of the Office Action mailed July 1, 2004. Claims 10-14 and 25 are presented for examination. Claims 1-9 and 15-24 have been canceled and Claim 25 has been added. Claims 10-14 have been amended to depend from Claim 25.

The claim amendments and new claim presented herein are fully supported by the specification, claims and drawings as originally filed. Specifically, new Claim 25 is supported by the specification at paragraph [0028]. No new matter has been added.

Rejection of Claims 1, 2, 4-9, 11-15 and 17-19 under 35 U.S.C. §103(a) over Dubin in view of Omura

Claims 1, 2, 4-9, 11-15 and 17-19 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Application Pub. No. 2004/0108217 by Dubin in view of U.S. Patent No. 6,028,362 to Omura. Initially, Applicants note that Claims 1, 2, 4-9, 15 and 17-19 have been canceled, and therefore the rejection of these claims is now moot. With regard to Claims 11-14, Applicants respectfully traverse this rejection.

Amended Claims 11-14 depend from new Claim 25, which is directed to an interconnect structure formed on a substrate. An embodiment of this interconnect structure is illustrated in Figure 2. The structure comprises a first layer of a first dielectric material having at least one first conductor embedded therein, and a second layer of a second dielectric material overlying the first layer of dielectric material and having at least one second conductor embedded therein. The first conductor has a top surface coplanar with a top surface of the layer of dielectric material. The second conductor comprises at least one first portion and at least one second portion, wherein the first portion is in electrical contact with the first conductor, the second portion is overlying and in electrical contact with the first portion, the second portion has a lateral extent greater than that of the first portion, and the second portion has a top surface

10/604,026

FIS920030130US1

coplanar with a top surface of the second layer of dielectric material. The interconnect structure also comprises a first conductive liner disposed on an underside and sidewalls of the second conductor, and a second liner disposed on an underside and sidewalls of the first portion of the second conductor. Thus, it is a feature of the present invention that two liners are disposed on an underside and sidewalls of the first portion of the second conductor, while only one liner is disposed on an underside and sidewalls of the second portion of the second conductor. Applicants respectfully submit that this feature of the present invention is neither disclosed nor suggested by Dubin in view of Omura, as follows.

The Dubin patent is directed to copper interconnect structures formed by co-plating of noble metals. In Figure 2, copper conductor 112' is shown surrounded on the underside and sidewalls only by barrier layer 108'. Notably, this is the only layer disposed on the underside and sidewalls of all portions of conductor 112', with no distinction between a first portion and a second portion. In other views of the Dubin structures, such as in Figure 1e, copper conductor 112 is shown surrounded on the underside and sidewalls by barrier layer 108 and seed layer 110. Both of these layers, however, are disposed on the underside and sidewalls of all portions of conductor 112, again with no distinction between a first portion and a second portion. Dubin, therefore, fails to disclose or even suggest two liners being disposed on an underside and sidewalls of a first portion of the conductor, while only one liner is disposed on an underside and sidewalls of the second portion of the conductor.

Omura fails to remedy the deficiencies of the Dubin patent in this regard. The Omura patent is directed to damascene wiring structures with a flat surface. In several of the Omura views, such as in Figure 11, conductor 52 is surrounded on an underside and sidewalls by adhesion layer 50, and conductor 44 is surrounded on an underside and sidewalls by barrier layer 54. None of the Omura views, however, show two liners being disposed on an underside and sidewalls of a first portion of a conductor, while only one liner is disposed on an underside and sidewalls of a second portion of the conductor, the second portion having a lateral extent greater than that of 10/604,026

FIS920030130US1

the first portion. Omura, therefore, fails to provide motivation to modify the teaching of Dublin in this regard.

Accordingly, Applicants respectfully submit that Claim 25 is patentable over Dublin in view of Omura. Claims 11-14, which include all of the limitations of Claim 25, are also patentable over Dublin in view of Omura. Applicants therefore request withdrawal of this rejection.

Rejection of Claims 3, 10 and 16 under 35 U.S.C. §103(a) over Dublin and Omura in view of Jain

Claims 3, 10 and 16 are rejected under 35 U.S.C. §103(a) as being unpatentable over Dublin and Omura, and further in view of U.S. Patent No. 5,821,168 to Jain. Initially, Applicants note that Claims 3 and 16 have been canceled, and therefore the rejection of these claims is now moot. With regard to Claim 10, Applicants respectfully traverse this rejection.

Amended Claim 10 depends from new Claim 25, which is directed to an interconnect structure formed on a substrate. It is a feature of the present invention that two liners are disposed on an underside and sidewalls of the first portion of the second conductor, while only one liner is disposed on an underside and sidewalls of the second portion of the second conductor. Applicants respectfully submit that this feature of the present invention is neither disclosed nor suggested by Dublin in view of Omura, and further in view of Jain, as follows.

As discussed previously, Dublin fails to disclose or even suggest the above-identified feature of the invention, and Omura fails to provide motivation to modify the teaching of Dublin in this regard.

Jain also fails to remedy the deficiencies of the Dublin and Omura teachings in this regard. The Jain patent is directed to a process for forming a semiconductor device, in which an insulating layer is nitrided and then covered by a thin adhesion layer before depositing a composite copper layer. Figure 9 of Jain shows a damascene interconnect structure which is very similar to that of Dublin's Figure 2.

10/604,026

FIS920030130US1

Specifically, conductor 74 is shown surrounded on the underside and sidewalls only by adhesion layer 58. Notably, this is the only layer disposed on the underside and sidewalls of all portions of conductor 74, with no distinction between a first portion and a second portion. Jain, therefore, fails to provide any motivation to modify the teaching of Dublin and Omura in this regard.

Accordingly, Applicants respectfully submit that Claim 25 is patentable over Dublin in view of Omura and further in view of Jain. Claim 10, which includes all of the limitations of Claim 25, is also patentable over Dublin in view of Omura and further in view of Jain. Applicants therefore request withdrawal of this rejection.

Conclusion

Applicants respectfully submit that the present application is now in condition for allowance. If the Examiner has any questions or believes further discussion will aid examination and advance prosecution of the application, a telephone call to the undersigned is invited.

10/604,026

FIS920030130US1

A fee of \$110.00 is believed to be due for the submission of this amendment. The Commissioner is authorized to charge this fee, and any other required fees, to Deposit Account No. 09-0458.

Respectfully Submitted,

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10/604,026

FIS920030130US1